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APPLICATION NUMBER: *60/510,905*
FILING DATE: *October 14, 2003*
RELATED PCT APPLICATION NUMBER: *PCT/US04/33714*

Certified by

Jon W Dudas

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for Intellectual Property
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10/14/03 11324 U.S. PTO

PROVISIONAL PATENT APPLICATION UNDER §111(b)	Attorney Docket No.	018778-9207
	First Named Inventor	Ronald Goodrich
	Express Mail Label No.	EV323582673US

1497 U.S. PTO 60/510905 101403

Mail Stop PROVISIONAL PATENT APPLICATION
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Enclosed for filing is a complete provisional patent application entitled "HYDRAULIC DRIVE SYSTEM FOR A WHEELCHAIR RAMP" invented by:

Ronald Goodrich
2716 Northwood Drive
Logansport, Indiana 46947

and including the following documents:

Specification including Claims - 6 pages
Abstract of the Disclosure
Drawings - 4 sheets
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Respectfully submitted,

Date: October 14, 2003

Martin L. Stern, Reg. No. 28,911
Michael Best & Friedrich LLC
401 North Michigan Avenue, Suite 1900
Chicago, Illinois 60611

cc: Docketing
Wkg Atty. DRM
Resp Atty. MLS

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PROVISIONAL PATENT APPLICATION FOR HYDRAULIC DRIVE SYSTEM FOR A WHEELCHAIR RAMP

FIELD OF THE INVENTION

[0001] The invention relates to hydraulic systems. More particularly, the present invention relates to a bi-directional hydraulic drive system for operating a vehicle wheelchair ramp.

BACKGROUND OF THE INVENTION

[0002] Wheelchair ramp systems for vehicles are well known, and have been employed to enable persons who are physically challenged or otherwise have limited mobility to board and leave a vehicle. Various wheelchair ramp systems have been proposed that include electrical, pneumatic, or hydraulic drive systems. Recently, hydraulic driven wheelchair ramp systems have become more prevalent due to their durability, reliability, and ability to be integrated with existing vehicle hydraulics. However, existing hydraulic systems are disadvantaged in that they are generally unduly complicated, requiring solenoid valves or the like to implement reversible operation of a ramp. Therefore, it would be advantageous to provide a simplified hydraulic system for reversible actuation of a wheelchair ramp.

[0003] U.S. Patent No. 5,391,041 to Stanbury et al. for "Hydraulically Operated Bus Ramp Mechanism," issued on February 21, 1995, discloses a hydraulic drive system for deploying and stowing a wheelchair ramp at the door of a vehicle. The hydraulic drive system includes a valve manifold that is electrically actuated and selectively switches high and low pressure lines to connect with the rod of the cylinder and piston ends or piston and rod ends, respectively, to effect reversible movement of the cylinder. A hydraulic drive system that operates in this manner and is dependent on correct and reliable valve actuation is unnecessarily complicated and inherently unreliable. Moreover, the ramp system is further disadvantaged by requiring the operator to monitor the ramp position using continuous actuation of a switch so that the "float down" feature may be employed.

[0004] U.S. Patent No. 6,179,545 to Petersen, Jr. et al. for "Flip-Over Ramp," issued on January 30, 2001, discloses a hydraulically driven, rotary actuated ramp system. The ramp system improves somewhat on the Stanbury et al. system by including a pair of sensors which operate to turn off the hydraulic system depending on the ramp position so that the ramp may

automatically "gravity down" from a generally vertical position. The pair of sensors or switches are actuated by a cam mounted to the ramp drive shaft. The hydraulic system of the '545 patent effects reversible operation through directional valves. Consistent with Stanbury et al., such directional valves are required in the prior art to route the hydraulic fluid by selectively switching the connections between various hydraulic lines depending on the requested ramp operation.

[0005] In light of the foregoing, there exists a long-felt need for a simplified and improved hydraulic drive system for wheelchair ramps that does not require valves for selective hydraulic fluid routing.

SUMMARY OF THE INVENTION

[0006] One embodiment of the invention provides a hydraulic drive system for reversibly operating a wheelchair ramp. The hydraulic drive system includes a bi-directional pump that directs hydraulic fluid to act on a cylinder for actuation of the ramp. The system includes a reservoir for storage of hydraulic fluid and at least two pressure relief valves. Each relief valve may be adjusted independently to regulate the pressure at either end of the cylinder, prevent the ramp from deploying or stowing if an object is present on the ramp, and prevent potential damage due to hydraulic pressure build-up in the system. Moreover, the system includes valves that are preferably spring biased shuttle-type valves. The cylinder is not locked, and the valves are preferably normally biased so that the cylinder and ramp may move freely such that the ramp may be manually operated during a power loss.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] The present invention is described with reference to the accompanying figures which illustrate embodiments of the present invention. However, it should be noted that the invention as disclosed in the accompanying figures and appendices is illustrated by way of example only.

[0008] FIG. 1 is an exemplary wheelchair ramp system in which the inventive bi-directional hydraulic system may be employed.

[0009] FIG. 2 is a system diagram of the inventive bi-directional hydraulic drive system.

[0010] Appendix A is a technical specification for one exemplary shuttle-type valve that may be used with the inventive bi-directional hydraulic drive system of FIG. 2.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

[0011] Referring now to the figures, and particularly FIG. 2, a hydraulic drive system 100 for a vehicle wheelchair ramp is shown. FIG. 1 shows the hydraulic drive system 100 for deploying and stowing an exemplary wheelchair ramp which is a bi-fold, flip-out ramp. However, the hydraulic drive system 100 is not to be limited for use with the ramp as shown, and may be employed for ramps such as the prior art ramps discussed above, and others. A bi-directional pump 10 has independent inlet/outlet ports and is in communication with reservoir 28. One exemplary bi-directional pump is model number 108BES19-Z56-1V-25-00-Y sold by the Oildyne Division of the Parker-Hannifin Corporation. Another exemplary bi-directional pump is part number BIROT-HS available from Monarch Hydraulics, Inc. of Grand Rapids, Michigan. A bi-directional pump10 , in combination with a reservoir 28 and other hydraulic components such as pressure relief valves or directional valves is known in the art as a hydraulic power unit. An exemplary hydraulic power unit 8 is shown in FIG. 1.

[0012] Referring now to FIG. 2, a first hydraulic line 30 is connected to a first inlet/outlet port 22 while a second hydraulic line 32 is connected to a second inlet/outlet port 24. Each of the hydraulic lines 30 and 32 are provided with a pressure relief valve 26 for depressurizing the line in case of unacceptable hydraulic pressure build up such as when a system component becomes blocked or frozen (e.g., hydraulic cylinder 16). In addition, since there is less surface area at the rod end 18 of the cylinder 16 for the hydraulic fluid to act on, a greater pressure (force) is required to retract the ramp than deploy it. Therefore, each pressure relief valve 26 is preferably adjusted independently to regulate the pressure at either end of the cylinder 16. Moreover, the pressure relief valves 26 may provide a safety feature by preventing the ramp from deploying or stowing if an object or obstruction is present on the ramp. For example, if ramp stowage is actuated accidentally while a user is on the ramp, hydraulic pressure will build up between the pump 10 and the rod end 18 of the cylinder 16 in excess of the typical pressure required to stow the ramp. The pressure relief valve 26 associated with the rod end 18 may be set to route fluid to the reservoir 28 when a predetermined pressure in excess of the typical pressure required for ramp stowage is reached, thereby preventing the ramp from operating until the user completes their traversal of the ramp.

[0013] The hydraulic cylinder 16 has a piston end 20 and a rod end 18. A first valve 12 is disposed between the first inlet/outlet port 22 and the cylinder piston end 20. Similarly, a second valve 14 is disposed between the second inlet/outlet port 24 and the cylinder rod end 18. As shown, the valves 12 and 14 are preferred to be normally-biased, spring-biased "shuttle" valves to simplify installation, operation and maintenance. Referring to Appendix A, one exemplary shuttle valve is the K04B3 available from Sterling Hydraulics, however valves 12 and 14 are not to be limited to such valves. Alternatively, the valves may be electrically actuated by solenoids or the like.

[0014] Since both valves are shown normally biased toward position 3, the rod of the cylinder and piston ends are connected by a hydraulic loop through the reservoir 28. This hydraulic loop configuration allows the ramp to be manually operated in a "float" mode when needed such as in the "gravity-down" mode or during loss of vehicle electrical power. Furthermore, flow restrictors 38, such as adjustable needle valves, in lines 34 and 36 are operative to limit hydraulic fluid flow thereby slowing or throttling the "gravity-down" operation of the ramp.

[0015] With reference to FIG. 1, when ramp deployment is desired, the bi-directional pump 10 is activated to pump fluid in a clockwise manner. The pump 10 draws hydraulic fluid from the reservoir 28 and forces the fluid out port 22 thereby building pressure in line 30. The increased hydraulic pressure in line 30 displaces the shuttle of valve 12 toward position (1) to seal off the reservoir 28. Therefore, the high pressure hydraulic fluid in line 30 is directed to flow in valve 12 from position (1) to position (2), and through line 34 to act on the piston end 20 of the cylinder 16. The piston moves outward thereby deploying the ramp. Fluid in the rod end 18 of the cylinder 16 is consequently dumped into the reservoir 28 through line 36 and valve 14 normally biased to position (3).

[0016] Conversely, when ramp stowage is desired, the bi-directional pump 10 is activated to pump fluid in a counter-clockwise manner. The pump 10 draws hydraulic fluid from the reservoir 28 and forces the fluid out port 24 thereby building pressure in line 32. The increased hydraulic pressure in line 32 displaces the shuttle of valve 14 toward position (1) to seal off the reservoir 28. Having sealed off the reservoir 28, the high pressure hydraulic fluid in line 32 is directed to flow through valve 14 from position (3) to position (2), and through line 36 to act

on the rod-end 18 of the cylinder 16. The piston moves inward thereby stowing the ramp. Fluid in the piston end 20 of the cylinder 16 is dumped into reservoir 28 through line 34 and valve 12 normally biased to position (3) open to the reservoir.

[0017] Preferred embodiments of this invention are described herein. Variations of those preferred embodiments may become apparent to those of ordinary skill in the art upon reading the foregoing description. The inventors expect skilled artisans to employ such variations as appropriate, and the inventors intend for the invention to be practiced otherwise than as specifically described herein. Accordingly, this invention includes all modifications and equivalents of the subject matter recited in the claims appended hereto as permitted by applicable law. Moreover, any combination of the above-described elements in all possible variations thereof is encompassed by the invention unless otherwise indicated herein or otherwise clearly contradicted by context.

WHAT IS CLAIMED IS:

1. A hydraulic drive system for a vehicle wheelchair ramp comprising:

a hydraulic cylinder for actuating a wheelchair ramp, the cylinder comprising a rod end and piston end;

a bi-directional pump operable to effect reversible movement of the hydraulic cylinder, the pump comprising first and second ports, said first port for acting on the cylinder rod end, and said second port for acting on the cylinder piston end; and

valves disposed between the ports and respective rod and piston ends, the valves normally biased to permit manual actuation of the wheelchair ramp.

ABSTRACT

Disclosed is a hydraulic drive system for hydraulic drive system for reversibly operating a wheelchair ramp. The hydraulic drive system includes a bi-directional pump which directs hydraulic fluid to act on a cylinder for actuation of the ramp. The system preferably includes one or more reservoirs for storage of hydraulic fluid, and at least two pressure relief valves. Each relief valve may be adjusted independently to regulate the pressure at either end of the cylinder, prevent the ramp from deploying or stowing if an object is present on the ramp, and prevent potential damage due to hydraulic pressure build-up in the system. Additionally, the system includes valves which are preferred to be spring biased shuttle-type valves. The cylinder is not locked, and the valves are preferably normally biased so that the cylinder and ramp may move freely such that the ramp may be manually operated during a power loss.

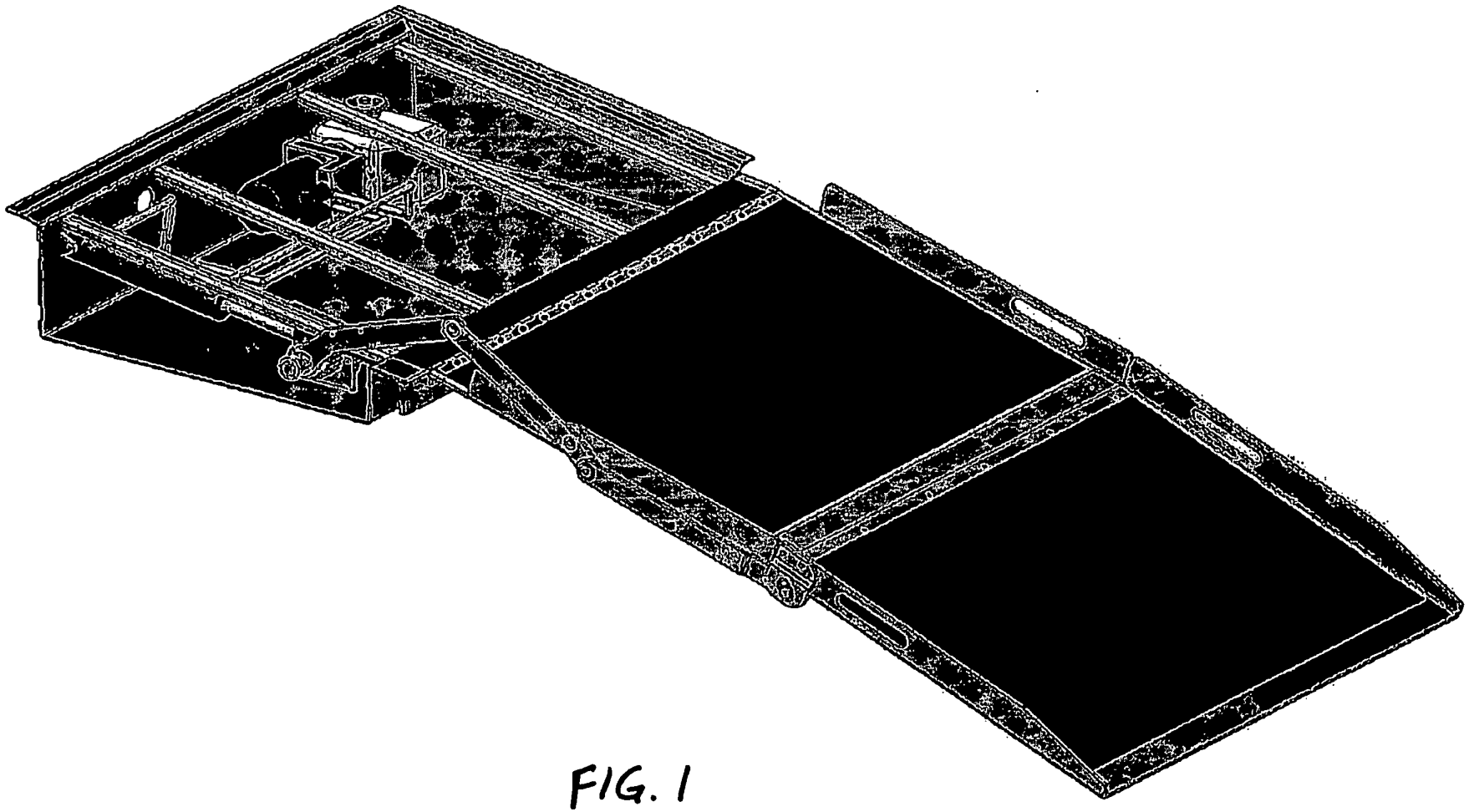

FIG. 1

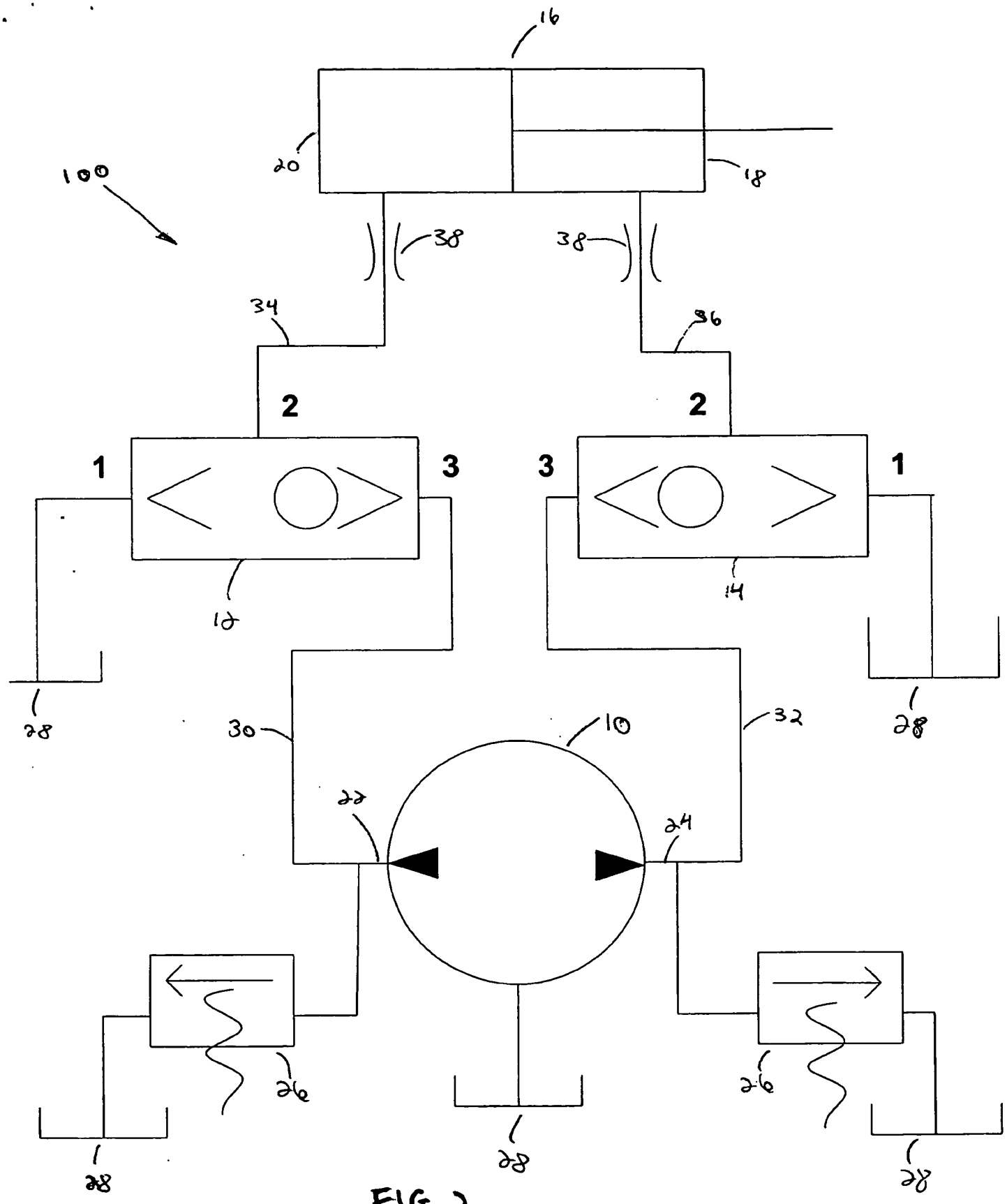
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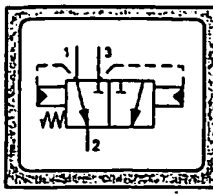
FIG. 2

APPENDIX A

SHUTTLE

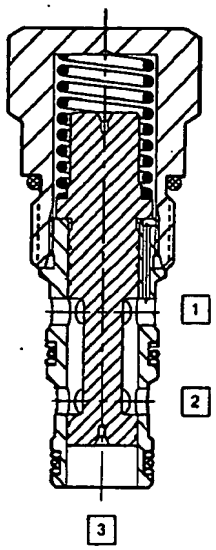


K04B3 UP TO 90 l/min 24 USGPM AND 420 BAR 6000 PSI

SHUTTLE VALVE

3 WAY, 2 POSITION, SPRING OFFSET

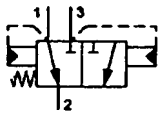
- High flow capacity.
- Various switching pressures available.
- Used as automatic brake release valve on motors, where brake release is required at pressures between 1 & 10 bar.
- Hardened working parts for maximum durability.
- External parts zinc plated.



OPERATION

The spring biased spool shifts allowing flow from the higher pressure port [1] or [3] to port [2], but in addition, the pressure on port [3] needs to exceed the spring setting to shift the spool.

SPECIFICATIONS

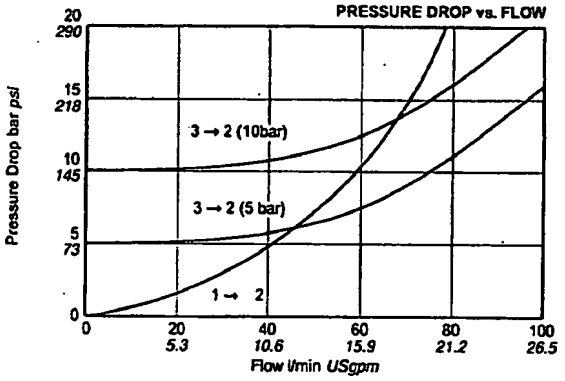
BASIC MODEL NUMBER	K04B3
SYMBOL	
NOMINAL FLOW AT Δp = 7 bar *100 psi*	50 l/min *13 USgpm*
PRESSURE	420 bar *6000 psi*
FLUID •	MINERAL OIL OR SYNTHETIC FLUID WITH LUBRICANT PROPERTIES
IDEAL VISCOSITY •	15 - 50 cSt *80 - 230 SSU*
SEAL MATERIAL / TEMPERATURE •	NITRILE (Std.) -30°C to +100°C *BUNA-N -20°F to +210°F* VITON -20°C to +150°C *-4°F to +330°F*
FILTRATION •	25 MICRONS (Nom.) OR BETTER
WEIGHT	0.14 kg *0.31 lb*
CAVITY	CAV04-3

• IMPORTANT: See pages *582-583* for additional notes on operating conditions.

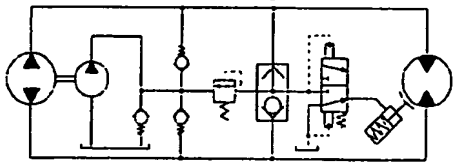
Specifications may change without notice

TYPICAL PERFORMANCE

Measured at 30 cSt *140 SSU* (For cartridge only)



APPLICATION



Brake release at various switching pressures.

STERLING HYDRAULICS

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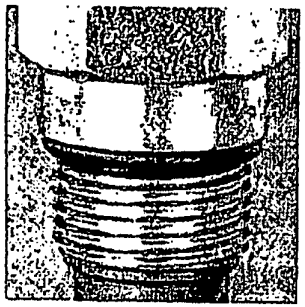

relief valves
sequence valves
pressure regulator valves
load control valves
solenoid valves
check valves
shuttle valves
diverters
flow regulator
flow divider
line body
cavity

SHUTTLE VALVES APPLICATION NOTES

BASIC FUNCTION

Shuttle valves are 3 port switching elements that are used to automatically select the direction of supply to a service relative to the opposing pressure levels in the two outer ports.

They are available as poppet or spool style valves, some of which may be spring centred to ensure a known starting position or switching level with spring bias pressures up to 15 bar (220 psi). The poppet valves offer low/zero leakage whilst the slightly higher leakage spool valves offer higher flow capability and optional spool configurations to interconnect either two high or two low pressure lines.

RANGE CAPABILITY

Sterling shuttle valves are suitable for use up to 420 bar (6000 psi) with flow capacities up to 175 l/min (46 USgpm).

STYLES AVAILABLE, KEY FEATURES AND APPLICATIONS

Shuttle valves are available in various styles, each with their own benefits and suitability to certain applications as detailed below.

BALL/POPPET TYPE SHUTTLE VALVE INSERTS

Model code: KSWA3, K2A005

These valves are for low/medium flow use to provide automatic selection of the higher pressure signal from either of the two outer ports. Being small screw-in inserts they are well suited to positioning deep inside a manifold block and for handling pilot control signals in general.

BALL TYPE SHUTTLE VALVE

Model code: K02A3, K04A3

These valves are for low/medium flow use to provide automatic selection of the higher pressure signal from either of the two outer ports such that the lower pressure port is closed to an almost zero leak condition.

Document made available under the Patent Cooperation Treaty (PCT)

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International filing date: 13 October 2004 (13.10.2004)

Document type: Certified copy of priority document

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